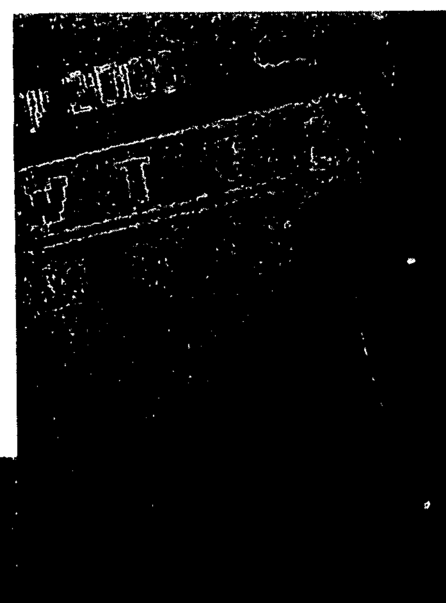
Professional Developer's Guide

GPRS and 3G Wireless Applications



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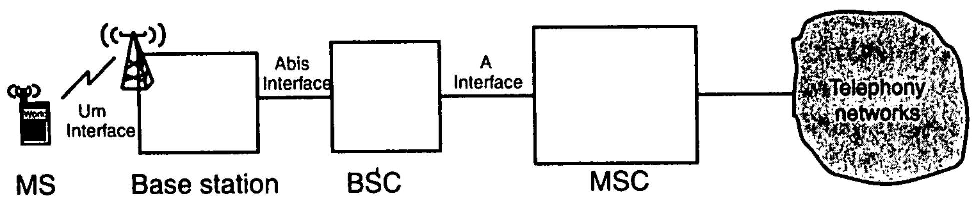

Figure 3.5 GSM system picture.

we have omitted some nodes. This figure includes the *Home Location Registry* (HLR), the *Authentication Center* (AuC), the *Equipment Identity Registry* (EIR), and the *Short Message Service Center* (SMS-C). These connect to the MSC via a *Signaling System 7* (SS7) network but will not play a central role in the discussions in this book.

One key force behind GPRS standardization is to make the transition as simple and as cost effective as possible. In other words, for instance, we should modify the base stations as little as possible. The base stations are, first of all, the lion's share of the equipment in which the operators have invested, and it is out of the question to replace them. Second, the base stations with their antennas are the elements of the network that create the coverage; thus, their deployment is spread out around the country in question. In order to facilitate maximum coverage, operators often place this equipment on rooftops and on hills, which makes it difficult and costly to perform on-site changes. A third and lesser-known reason is that the cell sites are often rented from the owner of the real estate (and, in some cases, from the tower's owner). The tower companies lease parts of the tower to different, often competing operators. Therefore, GPRS can be made as only a software upgrade (implementation specific; some have to do more) to existing base stations, which often can be done remotely from a central maintenance location. This software enables voice and data users to share the same air interface and to share base station resources, and it also makes it possible to develop new packet data-coding schemes. These coding schemes affect the resulting throughput of GPRS, and we describe them more in detail later in this chapter.

In GSM, the Abis interface is standardized to facilitate connectivity between multiple base stations and a BSC. This interface can remain unchanged when GPRS is introduced—again, to make the transition as smooth as possible. The data that goes over Abis consists of both GPRS packet data and GSM voice, because these components share the same air interface. In order to achieve efficient packet data handling, you need different core networks: the existing GSM core network for circuit-switched data and a new GPRS core network for packet data. We illustrate this concept in Figure 3.6.

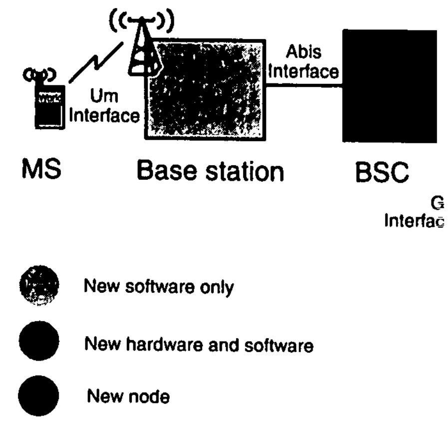

Figure 3.6 GPRS system architecture.

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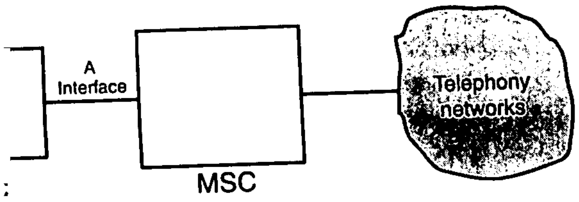

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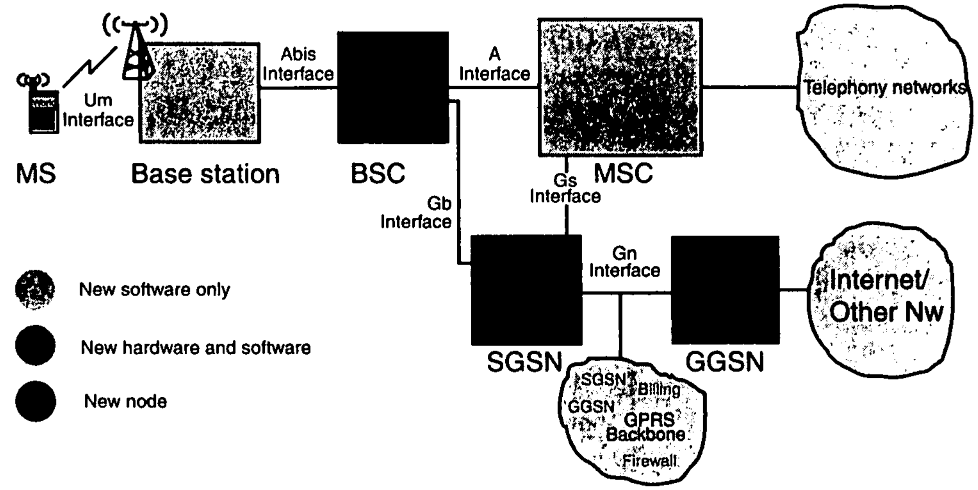

Figure 3.6 GPRS system architecture.

In other words, the BSC has to separate the different data flows and direct them to the right network. The additional functionality that it needs requires new hardware in the BSC: the *Packet Control Unit* (PCU). The PCU separates packet data and circuit-switched data when it is received from the MS and multiplexes the different data streams from circuit-switched and packet-switched core networks into common streams going down to the cells. The PCU is a separate entity and could potentially be located physically separate from the BSC. The BSC also gets its software upgraded for GPRS in order to enable it to handle the new logical packet data channels, the paging of GPRS handsets, and other packet data-specific functions of the air interface. Most of the new functionalities that we add to the GPRS air interface are thus implemented in the BSC. One BSC is connected to several base stations (varying from a just a few to hundreds of them per BSC), one MSC, and one *Serving GPRS Support Node* (SGSN).

The GPRS core network has two main nodes: the SGSN and the *Gateway GPRS Support Node* (GGSN), which together we call the GSN nodes. To connect these nodes to the radio network, a new open interface, Gb, is introduced. Gb is a high-speed Frame Relay link that is built running on an E1 or T1 connection. The connection between different GSN nodes and other components of the core network is called the GPRS backbone. The backbone is a regular IP network that has access routers, firewalls, gigabit routers, and so on. The backbone also usually connects to the operator billing system via a billing gateway (see the information later in this chapter). The backbone can also be used to connect to other GPRS operators.